Length distribution and total mortality rate Z of *Merluccius merluccius, Mullus barbatus* and *Eledone cirrhosa* exploited by the trawling fleet in 1982 and 1991 off the Catalan Coast (NW Mediterranean)

Paloma MARTIN and Pilar SANCHEZ

Instituto de Ciencias del Mar, BARCELONA (**Spain**)

Hake (*Merluccius merluccius*), striped mullet (*Mullus barbatus*) and white octopus (*Eledone cirrhosa*) are three of the main target species of the trawling fleet off the Catalan Coast. During the last ten years, catches have remained at a similar level. Hake catch was around 1800 tons during the period June 1982- May 1983, and 2400 tons in 1991; the striped mullet catch has been the same during all this period, about 700 tons per year; and the octopus catch (*Eledone cirrhosa* and *Octopus vulgaris*) was 1500 tons at the beginning of the period, and 1100 tons in 1991 (MARTIN, 1991; SANCHEZ & PDPEM, 1991).

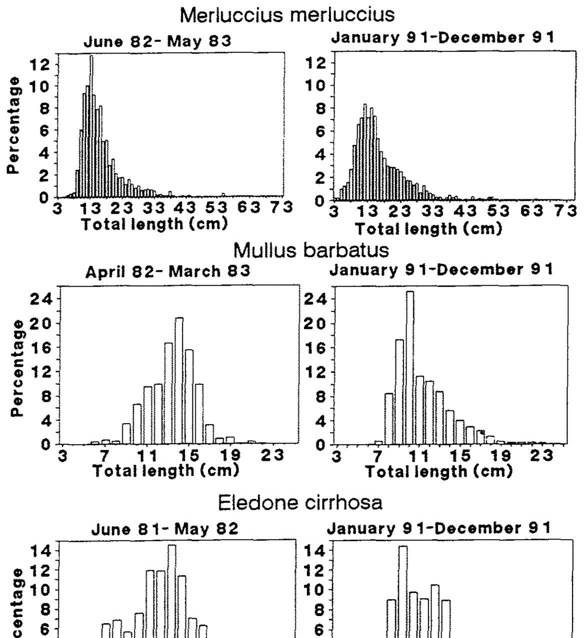
The range of exploited sizes has not changed significatively since 1981 in the three species (Figure 1). The mean length of catches has been the same in the case of hake (16.2 and 16.8 cm) and octopus (8.9 and 7.9 cm mantle length), while that corresponding to the striped mullet has decreased (from 13.4 cm to 11.3 cm).

	Merluccius merluccius		Mullus barbatus		Eledone cirrhosa	
	1982	1991	1982	1991	1982	1991
l min.	5.0	3.0	6.0	6.0	1.0	1.0
l mean	16.2	16.8	13.4	11.3	8.9	7.9
l max.	68.0	73.0	22.0	23.0	21.0	20.0
l'	13.0	12.0	14.0	10.0	10.0	6.0
lm	18.3	19.4	15.1	12.2	11.7	9.5
Z*	0.785	0.558	1.150	0.7		
Z**	0.435	0.377	0.694	0.469		
Catch (Ton)	1799.4	2386.5	674.8	694.8	1474.2	1118.3

1' smallest length fully recruited
1m mean length estimated from 1'

The smallest length fully represented in the catch samples (1'), in the three species, is very close to the mean length of the catch, which indicates that the exploitation is driven mainly towards the smallest lengths (class 0 and 1 in the hake and striped mullet, and recruits of the year in the white octopus).

During the period from 1982 to 1991, the fishing effort has undergone slight variations (466 vessels in 1982, 430 vessels in 1991). With respect to catches, these have remained at a similar level, which seems to indicate that an equilibrium in the exploitation has been achieved, centered mainly in the recruits (overexploitation of the recruitment).



REFERENCES

BEVERTON R.J.H. & HOLT S.J., 1956.- *Rapp. Conseil Explor. Mer,* 140 (1) : 67 - 83.
JONES R., 1984.- *FAO Fish. Tech. Pap.,* (256) : 118 pp.
MARTIN P., 1991.- *Inf. Téc. Sci. Mar.,* 162 : 43 pp.
SANCHEZ P. & PDPEM, 1991.- *Study of the impact of the small trawlers on the stocks of commercial species in the Catalan Coast.* Research Project report : 221 pp. Generalitat de Catalunya-CSIC.
This study has been partially financed by the Generalitat de Catalunya, Contract Ref. PCC 300 12/90.

Diagnosis of Chaos in a pelagic Ecosystem

S. MAZZOLA, B. PATTI, A. BONANNO and S. SGROSSO

Istituto di Tecnologia della Pesca e del Pescato, Consiglio Nazionale delle Ricerche, MAZARA DEL VALLO (**Italy**)

In order to achieve a "substainable development" is very important to manage natural resources. For an efficient management of the marine environmental, it's necessary to know the state of resources, their biology and how they interact with the environment. There is some experimental evidence that the abundance of the small pelagics, in a given marine area, shows strong time fluctuations and is, year by year, unpredictable. Several theoretical studies (MAY, 1976; MAY *et al*., 1979) demonstrated that the growth of some biological populations can exhibit a wide range of dynamical behaviours, from stable equilibrium points, to stable cycles with several points, through to a chaotic regime.

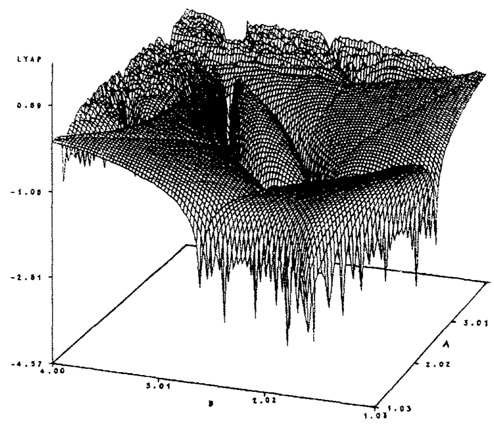
The dynamical behaviour of a population in chaotic regime makes unpredictable the amount of the biomass in a certain time. This problem makes the population dynamics models, useless for resources management purposes, particularly for the small pelagics. The diagnosis of the dynamical behaviour of pelagic ecosystem can be very useful to reduce management errors.

The aim of this paper is to describe a method for characterizing the turbulence in a biological population.

The figure shows a mapping of turbulence in a biological system obtained computing the Lyapunov exponent for a couple of values -a and -b representing the population fecundity parameter in the logistic equation. In this example it's possible to observe, to the top side of the plot (right and left), the typical structure of turbulence. The analisys of this maps allows to get usefull informations for practical applications.

The classical method utilized to diagnose the turbulence have some limitation, because, 1) needs a high number of input points for the mathematical convergency and 2) shows only the presence or absence of the chaos but not the intermediate levels (OLSEN *et al*., 1985). The first problem affects the possibility to apply in the future this method to the natural populations, in which the amount of the measures is often low, specially in the marine environment, where the data sampling is very expensive. The second problem limits the amount of the information and it doesn't allow a thicher characterization.

Our method is based on the classical turbulence theory of KOLMOGOROV (KOLMOGOROV, 1941). For testing our method we have simulated the dynamic behaviour of a biological population by means a simple model namely the simplest of all non linear population models - the discrete generation logistic growth equation. Given a particular iterate it's possible to obtain its position in the "Kolmogorov spectrum". **Our results demonstrate how** is possible to overcome the limits of classical methods.



REFERENCES

MAY R.M., 1976.- Simple mathematical models with very complicated dynamics. *Nature,* London, 261: 459-467.
MAY R.M., BEDDINGTON J.R., CLARK C.W., HOLT S.J. & LAWS R.M., 1979.- Management of Multispecies Fisheries. *Science,* 205 (4403) : 267-277.
KOLMOGOROV A.N., 1941.- Local structure of turbulence in an inconpressible fluid at very high Reynolds numbers. *Doklady AN SSSR,* 30 (4) : 299-303.
OLSEN L.F. & DEGN H., 1985.- Chaos in biological systems. *Quarterly Review of Biophysics,* 18 (2) : 165 - 225.

V